IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Original): A signal separating apparatus which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency domain transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain;

a normalizing section which normalizes a complex vector generated by using the mixed signals in the frequency domain to generate a normalized vector excluding frequency dependence of the complex vector; and

a clustering section which clusters the normalized vectors to generate clusters.

Claim 2 (Original): A signal separating apparatus according to claim 1, wherein the normalizing section comprises:

a first normalizing section which normalizes the argument of each of the elements of the complex vector by using one particular element of the complex vector as a reference; and

a second normalizing section which divides the argument of each of the elements normalized by the first normalizing section by a value proportional to a frequency.

Claim 3 (Original): A signal separating apparatus according to claim 2, wherein the normalizing section further comprises a third normalizing section which normalizes the norm of a vector consisting of the elements normalized by the second normalizing section to a predetermined value.

Claim 4 (Original): A signal separating apparatus which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain;

a separation matrix computing section which calculates a separation matrix for each frequency by using the mixed signals in the frequency domain;

an inverse matrix computing section which calculates a generalized inverse matrix of the separation matrix;

a basis vector normalizing section which normalizes basis vectors constituting the generalized inverse matrix to obtain normalized basis vectors;

a clustering section which clusters the normalized basis vectors to generate clusters; and

a permutation computing section which uses center vectors of the clusters and the normalized basis vectors to calculate a permutation used for rearranging the elements of the separation matrix.

Claim 5 (Original): A signal separating apparatus according to claim 4, wherein the basis vector normalizing section performs normalization that eliminates frequency dependence from the basis vectors.

Claim 6 (Original): A signal separating apparatus according to claim 5, wherein the normalization that eliminate frequency dependence from the basis vectors normalize the argument of each element of each of the basis vectors by using one particular element of the

basis vector as a reference and divides the argument of each element by a value proportional to a frequency.

Claim 7 (Original): A signal separating apparatus according to claim 5, wherein the normalization that eliminates frequency dependence from the basis vectors is performed by calculating

[Formula 64]

$$A_{qp}'(f) = |A_{qp}(f)| \exp\left[j \frac{\arg[A_{qp}(f)/A_{Qp}(f)]}{4fc^{-1}d} \right]$$

for each element $A_{qp}(f)$ (where q = 1, ..., M and M is the number of sensors observing the mixed signals) of the basis vectors $A_p(f)$ (where p = 1, ..., N and N is the number of signal sources), where exp is Napier's number, arg[·] is an argument, f is a frequency, j is an imaginary unit, c is signal transmission speed, Q is a reference value selected from natural numbers less than or equal to M, and d is a real number.

Claim 8 (Previously Presented): A signal separating apparatus according to claim 7, wherein "d" is a longest distance d_{max} in distances between a reference sensor corresponding to the element $A_{Qp}(f)$ and other sensors.

Claim 9 (Original): A signal separating apparatus according to claim 4, wherein the basis vector normalizing section performs normalization that eliminates frequency dependence from the basis vectors and normalization that normalizes the norms of the basis vectors to a predetermined number.

Claim 10 (Original): A signal separating apparatus which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain;

a separation matrix computing section which calculates a separation matrix for each frequency by using the mixed signals in the frequency domain;

an inverse matrix computing section which calculates a generalized inverse matrix of the separation matrix;

a basis vector normalizing section which normalizes basis vectors constituting the generalized inverse matrix to obtain normalized basis vectors;

a clustering section which clusters the normalized basis vectors to generate clusters; and

a permutation computing section which uses an envelope, the center vectors of the clusters, and the normalized basis vectors to calculate a permutation used for sorting elements of the separation matrix, the envelope being a separated signal obtained from the frequency-domain mixed signals and one of the separation matrix and a separation matrix generated by rearranging the separation matrix.

Claim 11 (Original): A signal separating apparatus which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency domain transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain;

a signal separating section which calculates a separation matrix and separated signals for each frequency by using the mixed signals in the frequency domain; and

a target signal selecting section which normalizes basis vectors which are columns of a generalized inverse matrix of the separation matrix, clusters the normalized basis vectors, and selects selection signals including a target signal from among the separated signals by using the variance of the clusters as an indicator.

Claim 12 (Original): A signal separating apparatus according to claim 11, further comprising:

a mask generating section which generates a time-frequency mask by using the mixed signals in the frequency domain and the basis vectors; and

a masking section which applies the time-frequency mask to the selection signals selected by the target signal selecting section to generate masked selection signals.

Claim 13 (Original): A signal separating apparatus according to claim 12, wherein the mask generating section comprises:

a whitening matrix generating section which generates a whitening matrix by using the mixed signals in the frequency domain;

a whitening section which uses the whitening matrix to transform a mixed-signal vector consisting of the mixed signals in the frequency domain into a whitened mixed-signal vector and to transform the basis vectors into whitened basis vectors;

an angle computing section which computes the angle between the whitened mixed-signal vector and the whitened basis vector for each time-frequency; and

a function operation section which generates the time-frequency mask which is a function including the angle as an element.

Claim 14 (Original): A signal separating apparatus according to claim 13, wherein the whitening matrix is $V(f) = R(f)^{-1/2}$, wherein $R(f) = \langle X(f, \tau) \cdot X(f, \tau)^H \rangle_\tau$, f is a frequency, τ is discrete time, $X(f, \tau)$ is the mixed-signal vector, $\langle * \rangle$ is a time-averaged vector of a vector "*", and "$*^H$" is a complex conjugate transposed vector of the vector "*";

the whitening section calculates the whitened mixed-signal vector $Z(f, \tau)$ as $Z(f, \tau) = V(f) \cdot X(f, \tau)$ and calculates the whitened basis vector $B(f)$ as $B(f) = V(f) \cdot A(f)$ where the basis vector is $A(f)$;

the angle computing section calculates the angle $\theta(f, \tau)$ as $\theta(f, \tau) = \cos^{-1}(|B^H(f) \cdot Z(f, \tau)| / \| B(f) \| \cdot \| Z(f, \tau) \|)$, where $|*|$ is the absolute value of a vector "*" and $\| * \|$ is the norm of the vector "*"; and

the function operation section calculates a logistic function $M(\theta(f, \tau)) = \alpha/(1+e^{g \cdot (\theta(f,\tau)-\theta T)})$ as the time-frequency mask, where α, g, and θ_T are real numbers.

Claim 15 (Currently Amended): A signal separating apparatus according to claim 12, wherein the mask generating section comprises:

a frequency normalizing section which normalizes a mixed-signal vector $X(f, \tau)$ generated by using the mixed signals in the frequency domain to a frequency-independent frequency-normalized vector $X'(f, \tau)$;

a first norm-normalizing section which normalizes the frequency-normalized vector $X'(f, \tau)$ to a norm-normalized vector $X''(f, \tau)$ whose norm has a predetermined value;

a centroid selecting section which extracts centroids η_ι corresponding to the selection signals;

a second norm-normalizing section which normalizes the centroids η_ι corresponding to the selection signals to norm-normalized centroids η_ι whose norm has a predetermined value;

a squared distance computing section which calculates the square DS(f, τ) of the distance between the norm-normalized vector ~~X'(f, τ)~~ X'' (f, τ) and the norm-normalized centroids η_ι'; and

a function generating section which generates the time-frequency mask using a function including the square of the distance DS(f, τ) as an element.

Claim 16 (Original): A signal separating apparatus according to claim 11, wherein the target signal selecting section performs normalization that eliminate frequency dependence from the basis vectors.

Claim 17 (Original): A signal separating apparatus according to claim 16, wherein the normalization that eliminates frequency dependence from the basis vectors normalizes the argument of each element of the basis vectors by using one particular element of the basis vector as a reference and divides the argument of each element by a value proportional to a frequency.

Claim 18 (Original): A signal separating apparatus according to claim 17, wherein the normalization that eliminates frequency dependence from the basis vectors is performed by calculating

[Formula 65]

$$A_{qp}'(f) = |A_{qp}(f)| \exp\left[j \frac{\arg[A_{qp}(f)/A_{Qp}(f)]}{4fc^{-1}d} \right]$$

for each element $A_{qp}(f)$ (where q = 1, ..., M and M is the number of sensors observing the mixed signals) of each of the basis vectors $A_p(f)$ (where p is a natural number), where exp is Napier's number, arg[·] is an argument, f is a frequency, j is an imaginary unit, c is signal transmission speed, Q is a reference value selected from natural numbers less than or equal to M, and "d" is a real number.

Claim 19 (Previously Presented): A signal separating apparatus according to claim 18, wherein the real number "d" is a longest distance d_{max} in distances between a reference sensor corresponding to the reference value Q and-other sensors.

Claim 20 (Original): A signal separating apparatus according to claim 11, wherein the target signal selecting section performs normalization that eliminates frequency dependence from the basis vectors and normalization that normalizes the norms to a predetermined value.

Claim 21 (Original): A signal separating apparatus according to claim 11, wherein the target signal selecting section selects a cluster that provides the minimum variance and selects separated signals corresponding to the selected cluster as the selection signals.

Claim 22 (Original): A signal separating apparatus which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain;

a vector normalizing section which normalizes a mixed-signal vector consisting of the mixed signals in the frequency domain to obtain a normalized vector;

a clustering section which clusters the normalized vector to generate clusters; and

a separated signal generating section which extracts a predetermined ordinal number-th element of the mixed-signal vector corresponding to the time-frequency of the normalized vector that belongs to the k-th cluster and generates a separated-signal vector having the element as the k-th element.

Claim 23 (Original): A signal separating apparatus according to claim 22, wherein the vector normalizing section performs normalization that eliminate frequency dependence from the mixed-signal vector consisting of the mixed signals in the frequency domain.

Claim 24 (Original): A signal separating apparatus according to claim 23, wherein the normalization that eliminates frequency dependence from the mixed-signal vectors has a normalization of the argument of each element of each of the basis vectors by using one particular element of the mixed-signal vector as a reference and a division of the argument of each element by a value proportional to a frequency.

Claim 25 (Original): A signal separating apparatus according to claim 24, wherein the normalization that eliminates frequency dependence of the mixed-signal vectors is performed by calculating

[Formula 66]

$$X_q'(f,\tau) = |X_q(f,\tau)| \exp\left[j \frac{\arg[X_q(f,\tau)/X_Q(f,\tau)]}{4fc^{-1}d} \right]$$

wherein M is the number of sensors, $q = 1, \ldots, M$, $X_q(f, \tau)$ denotes each of the elements of the mixed-signal vector, exp is Napier's number, $\arg[\cdot]$ is an argument, j is an imaginary unit, c is signal transmission speed, Q is a value selected from natural numbers less than or equal to M, d is a real number, f is a frequency, and τ is discrete time.

Claim 26 (Previously Presented): A signal separating apparatus according to claim 25, wherein "d" is a longest distance d_{max} in distances between a sensor corresponding to the element $X_Q(f, \tau)$ and other sensors.

Claim 27 (Original): A signal separating apparatus according to claim 22, wherein the vector normalizing section performs normalization that eliminates frequency dependence from the mixed-signal vectors and normalization that normalizes the norms to a predetermined value.

Claim 28 (Original): A signal separating method for separating mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising the steps of:

transforming the mixed signal observed by a plurality of sensors into mixed signals in the frequency domain and outputting the transformed mixed signals;

calculating a separation matrix for each frequency by using the mixed signals in the inputted frequency-domain;

calculating a generalized inverse matrix of the inputted separation matrix and outputting the calculated generalized inverse matrix;

normalizing basis vectors constituting the inputted generalized inverse matrix to obtain normalized basis vectors;

clustering the inputted normalized basis vectors to generate and output clusters; and

using the center vectors of the inputted clusters and the normalized basis vectors to calculate a permutation used for rearranging elements of the separation matrix and outputting the calculated permutation.

Claim 29 (Original): A signal separating method for separating mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising the steps of:

transforming the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain and outputting the transformed mixed signals;

calculating a separation matrix and separated signals for each frequency by using the inputted frequency-domain mixed-signals; and

normalizing basis vectors which are columns of a generalized inverse matrix of the inputted separation matrix, clustering the normalized basis vectors, and selecting selection signals including a target signal from among the inputted separated signals by using variance of the clusters as an indicator.

Claim 30 (Original): A signal separating method for separating mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising the steps of:

transforming the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain and outputting the transformed mixed signals;

normalizing a mixed-signal vector consisting of the inputted frequency-domain mixed signals to obtain a normalized vector and outputting the normalized vector;

clustering the inputted normalized vector to generate clusters and outputting the clusters; and

extracting a predetermined ordinal number-th element of the mixed-signal vector corresponding to the time-frequency of the normalized vector that belongs to the k-th cluster and generating and outputting a separated-signal vector having the element as the k-the element.

Claim 31 (Previously Presented): A computer-readable recording medium including a signal separating program, which when executed by a computer causes the computer to function as a signal separating apparatus according to claim 1.

Claim 32 (Canceled).